# Geochemistry of K/T boundaries in India and contributions of Deccan Volcanism

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Three possible K/T boundary sections in the Indian subcontinent have been studied for their geochemical and fossil characteristics. These include two marine sections of Meghalaya and Zanskar and one continental section of Nagpur.

The Um Sohryngkew river section of Meghalaya (1,2) shows a high iridium, osmium, iron, cobalt, nickel and chromium concentration in a 1.5 cm thick limonitic layer about 30 cm below the planktonic Cretaceous- Palaeocene boundary identified by the characteristic fossils. These elements are enriched by factors of 24, > 5, 4.5, 12, 10 and 9 respectively in comparison to the adjacent shales and have peak concentrations of 12.1 ng/g, 4.7 ng/g, 16.2%, 148 $\mu$g /g, 2513 $\mu$g /g and 934 $\mu$g /g. Simultaneous enrichment of several rare earths by a factor of 5 to 7 is found to occur in the same horizon, compared to the palaeocene shales. The stratigraphy of some of these elements and Ca and Ba is shown in figure 1. We have also analysed the Bottaccione and Contessa sections at Gubbio for these elements. The geochemical pattern at the boundary at the Um Sohryngkew river and Gubbio sections are similar but the peak concentrations and the enrichment factors are different. The limonitic layer and the horizons just above in the Meghalaya section are devoid of planktonic foraminifera (2). Two planktonic zones can be distinguished within about a meter above the limonitic layer. The lower zone contains the residual cretaceous planktonics whereas the upper zone contains dimunitive planktonic suites. The characteristic palaeocene planktons appear about 50 cm above the limonitic layer. Assuming a uniform sedimentation rate of 6.5 mm/ka as determined by typical Palaeocene divisions the data show that the key cretaceous genera survived across the limonitic layer for a duration of $\sim$ 40 ka. Their actual disappearance occurs much after the ecological stress of the limonitic layer. The new palaeocene foraminifera first appear about 70 ka after the limonitic layer was deposited. The biological boundary is not as sharp as the geochemical boundary and the extinction appears to be a prolonged process. The Zanskar section shows, in general, similar concentration of the siderophile,lithophile and rare earth elements but no evidence of enrichment of siderophiles has so far been observed. Detailed work at close intervals is now in progress.

The Takli section, situated in Nagpur (3), is a shallow inter-trappean deposit within the Deccan province, sandwiched between flow I and flow II. It was deposited within the magnetic 29R chron and it contains the uppermost level where dinosaur fossils have been found. The flow I and II yield radiometric dates within 2 Ma of the K/T event.

The geochemical stratigraphy of the inter-trappeans is shown in figure 2. The various horizons of ash, clay and marl show concentration of Fe and Co, generally lower than the adjacent basalts (4). The general level of iridium is $\sim$ 30 pg/g in flow I and II and below 100 pg/g in the inter trappeans. Two horizons of slight enrichment of iridium, by a factor of 4 or 5 above the average level are found within the ash layers, one near the contact of flow I and other near the contact of flow II, where iridium occurs at 170 and 260 pg/g. These levels are lower by a factor of 30 compared to Ir concentration in the K/T boundary in Meghalaya section. If the enhanced level of some elements in a few horizons of the ash layer are considered as volcanic contribution by some fractionation processes than the

only elements for which it occurs are REE, Ir and possibly Cr. The volcanic contribution to enrichment of siderophile elements in the marine K/T boundary layer, if any, is thus negligible.

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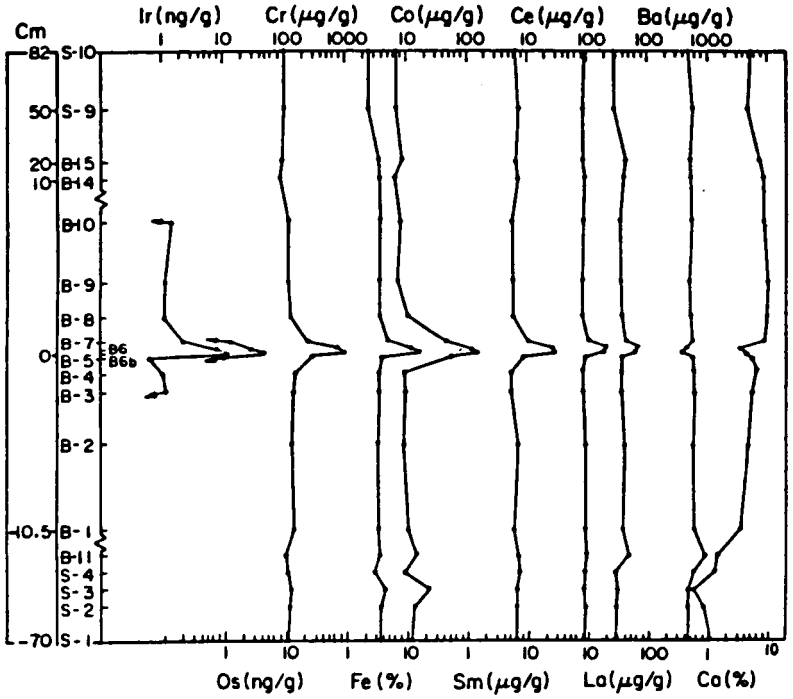


Fig.1

Meghalaya Section

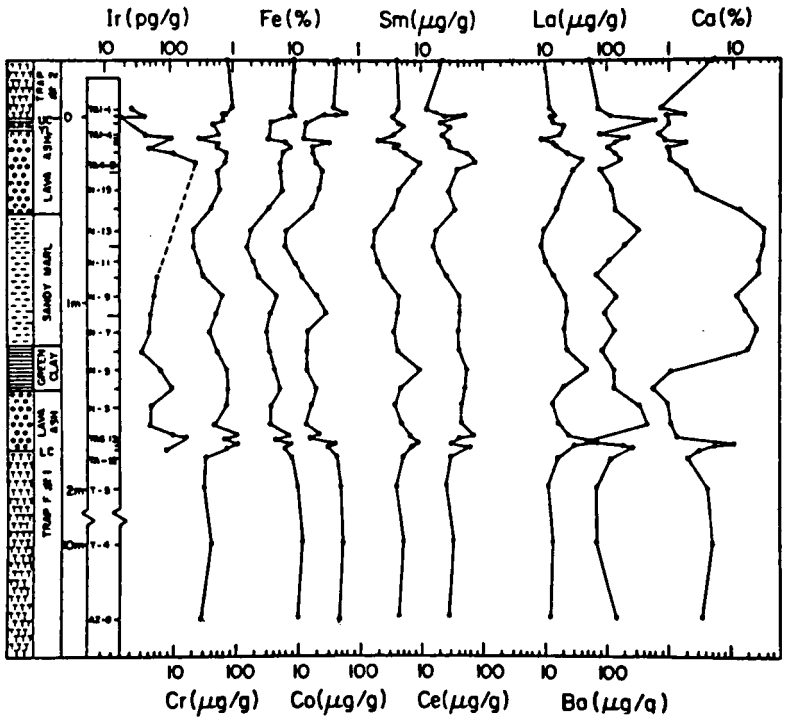


Fig.2

Nagpur Section